Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C. 20554

In the Matter of	)	
	)	
Creation of a Low	)	MM Docket No. 99-25
Power Radio Service	)	
	)	RM-9208
	)	RM-9242

Reply Comments of the National Association of Broadcasters

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EXECUTIVE SUMMARY

The National Association of Broadcasters ("NAB") submits these reply comments in the Commission's Low Power Radio Service ("LPFM") proceeding. NAB remains opposed to the establishment of any LPFM service. NAB believes the Commission cannot move forward with its proposals based on the technical information provided by NAB and others.

NAB submitted a comprehensive receiver study as part of our substantial filing during the comment phase of this proceeding. Three other receiver studies were also submitted, and NAB commissioned two independent analyses of the four receiver studies. Moffet, Larson and Johnson, the engineering firm hired to develop our receiver study, provided one report. Dr. Raymond Pickholtz and Dr. Charles Jackson were retained to provide the other report of the receiver studies and offer their conclusions. These reports are attached as appendices to NAB's reply comments.

After careful review of the methodologies, standards used and type of receivers tested – among other things – both reports conclude that NAB's receiver study, and its conclusions, represent the facts regarding this issue. NAB tested the most representative sample of radios – for both function and price. NAB used the correct methodology based on industry practice in our testing. Additionally, NAB's conclusion that the Commission cannot eliminate second and third adjacent channel separations to make room for LPFM is not rebutted by either the study submitted by the National Lawyers Guild ("NLG") or by the Office of Engineering and Technology's ("OET") Interim Report.

Both independent reports found the OET and NLG's did not use the proper criteria to measure the potential for interference. They found that measuring distortion was not a traditionally supported standard because it does not correlate to subjective consumer preferences.

However, the NLG study did report audio signal-to-noise ratio data and by analyzing this data using standard interference criteria, the NLG study data actually supports the conclusions reached by NAB and CEMA.

The reports conclude that the studies do not support the Commission's assumption that receivers have improved with regard to interference rejection performance. Thus, the Commission cannot relax second or third adjacent channel protections for LPFM.

In reply, NAB addresses concerns from Commission staff and other commenters regarding our receiver study. Specifically, the Commission cannot reject our study merely because some receivers we tested performed poorly before interference was injected. The median performance ratios do not significantly change even if results for the worst performing radios are removed. In fact, our data clearly illustrates that second and third adjacent channel protection criteria cannot be relaxed regardless of what receiver antenna height is assumed.

NAB believes that it would inappropriate for the Commission to allow LPFM stations to accept interference from full power stations. As noted in our Comments, LPFM stations would already face high levels of interference based on our receiver study. For the Commission to allow these stations to operate in such an environment because it would degrade the quality of overall FM service and contravene the Commission's policy of providing quality radio service.

Further, in reply, NAB asks the Commission to listen to the experts when it comes to In-Band, On-Channel ("IBOC") digital radio. LPFM proponents do not understand IBOC technology, nor the spectrum limitations facing terrestrial broadcasters as they attempt to move into the digital age. The Commission should take the time to adequately address the IBOC issues by waiting for the IBOC proponents to finish their testing so the full impact of any LPFM

proposal can be measured against the IBOC systems that have been in development for nearly a decade.

NAB believes that there can be no further compromise of interference-free radio service. Such a compromise would entail the Commission eliminating third adjacent channel protections for LPFM, but retaining second adjacent channel restrictions. In these reply comments, NAB provides information on the interference impact of only eliminating third adjacent channel protections for three cities from the FCC's feasibility study. While the population affected would be reduced, it is important to note that the number of "available" LPFM allocations would be almost cut in half. Further, the Commission should remain focused on the tangible, actual performance of today's radios. It should not continue to compromise the integrity of the FM band – as it did in Docket 80-90 – to provide for LPFM merely because it believes interference may already be present due to its past decisions. LFPM cannot be justified on that basis.

NAB takes issue with the assumption of LPFM proponents that local radio stations no longer provide local service. The record in this docket is replete with examples of all of the quality, local programming that currently exists through full-power broadcasting. The Commission must not forget the impact on these stations with the implementation of LPFM. The likely result would be a decrease in service to the public, not the increase that the Commission assumes.

Finally, the Commission has failed to consider the huge issues revolving around whether it can implement this proposal in a manner that meets its goals. LPFM channels would have to be allocated and applied for under yet to be defined market or community definitions using an application system that is merely a dream yet to be realized. Speculative plans on how to get this service off the ground will only lead these proposals nowhere. Further, the Commission should

look to a present day example regarding low power services in Australia when it is evaluating its ability to enforce an LPFM service. Australia's experience with a low power radio system has not turned out as it was intended. Stations operate above power and do not provide the type of service envisioned, but are more like a commercial radio station. While Australia does not have the same overall numbers of full power stations to regulate as the Commission, the combination of full power stations and the potential for LPFM stations in the U.S. would threaten to disintegrate the U.S. radio environment into chaos.

The Commission must consider all of these issues before adopting an LPFM service. Based on the comments and studies reviewed by NAB, the only conclusion is that the proposed LPFM service is unfeasible, unjustified and irreversible, if implemented.

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Reply Comments of the National Association of Broadcasters

I. INTRODUCTION

The National Association of Broadcasters ("NAB") submits these reply comments in the above captioned proceeding. NAB remains adamantly opposed to the institution of any low power radio service. In our Comments submitted on August 2, 1999, NAB addressed each of the Commission's assumptions regarding the need for this service and the assumptions regarding the technical issues – primarily that receivers have improved enough to reject interference from second and third adjacent stations, and showed that these assumptions are unfounded.[1] We provided a comprehensive receiver study that demonstrated that FM receivers have not improved, and indeed do not generally perform up to the Commission's present assumptions. The other receiver studies, properly evaluated, do not contradict our findings. The ultimate conclusion from this evidence is that the Commission cannot eliminate interference protections

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1 *See* Comments of NAB in MM Docket No. 99-25, filed August 2, 1999.

because doing so would cause substantial interference to existing services. As admitted by the Commission itself, eliminating these protections is the only way any sort of viable LPFM service can be established to meet the goals that the Commission perceives to exist.[2]

In reply, NAB provides two comparisons of the submitted studies that further establish that our methodology and testing was the proper way to determine the interference that LPFM would create. One report is from Moffet, Larson and Johnson, the engineering firm that developed our test model. Dr. Raymond Pickholtz and Dr. Charles Jackson also were retained by NAB to provide an independent analysis of the four major receiver studies in the record.

In addition to the receiver studies, two of the three In-Band, On-Channel digital audio broadcasting ("IBOC DAB") proponents filed comments expressing their concerns about the LPFM proposal and its effect on their ability to provide existing analog terrestrial broadcasters the chance to move into the digital world. IBOC DAB proponents have spent the better part of the last decade developing a digital system that will not require new spectrum to implement. The Commission has been a long supporter of such a concept and should not take steps with LPFM that will stall or eliminate the possibility of digital radio for existing stations.[3] There is no real way to understand what effect LPFM stations would have on the transition to IBOC until an IBOC standard has been adopted and implemented by the Commission.

On November 1, 1999, the Commission released its *Notice* on digital audio broadcasting ("DAB").[4] IBOC was one of the models presented by the FCC for digital radio. As in this

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2 In the Matter of Creation of a Low Power Radio Service, MM Docket No. 99-25, at ¶ 42 (released February 3, 1999) [hereinafter *LPFM Notice*].

3 *See, e.g.*, In the Matter of Digital Audio Broadcasting Systems and Their Impact on the Terrestrial Radio Broadcast Service, MM Docket No. 99-325 (released November 1, 1999) [hereinafter *DAB Notice*].

4 *Id.*

proceeding, the Commission asks how an IBOC system and LPFM service can be compatible. As NAB has stated before, compatibility cannot be properly measured at least until IBOC systems are fully tested. LPFM should not supercede radio's transition to digital with the attendant benefits to the public. The Commission cannot make a sound policy decision without waiting for IBOC testing results.

Finally, in reply, NAB will address some of the comments submitted by LPFM proponents. What is abundantly clear is that most LPFM proponents simply list their demands for service without providing any justification or reasoning why the Commission has the ability to change its policies, its regulations or disregard applicable statutes.

II. TECHNICAL ISSUES

The LPFM proposal hinges on whether it is technically possible for the Commission to engineer a feasible service to achieve the stated goals of the proposal while not harming existing broadcasters and their listeners – either in existing analog operations or in the eventual transition to digital broadcasting. In our Comments, NAB provided the evidence to show that it is not feasible. Further, our conclusions regarding the impact on the transition to digital radio are supported by the initial analyses of IBOC system proponents.

While the Comments of Civil Rights Organizations[5] contain no technical analyses, nor address any of the technical issues at all, they propose a "Rule" that when applied to the LFPM proposal from a technical standpoint supports NAB's view that LPFM should not be established. MMTC, *et al.* relies heavily on "The Rule of Nonreversibility" in their comments. The Rule they propose is: "An agency should avoid decisions that cannot be changed later without

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5 Comments of Civil Rights Organizations in MM Docket No. 99-25, filed August 3, 1999 [hereinafter MMTC *et al.*].

upsetting the legitimate expectations of those who invested time, money and effort in good faith."[6]

MMTC, *et al.* apply this Rule in many different respects when they are justifying their position on some of the policy issues surrounding the LPFM proposal. However, when this Rule is applied when addressing the LPFM technical issues, the "Rule of Nonreversibility" would dictate that the Commission should not implement LPFM at all.

Existing broadcasters have a legitimate expectation that they can and will reach their audiences. They have invested time, money and effort, all in good faith. The same is true for consumers who have purchased hundreds of millions of FM radios that function in the current interference environment.

Based on the receiver studies submitted in this proceeding and on the initial analyses of IBOC proponents, should the Commission make the decision to go forward with LPFM, the change in the rules would harm existing broadcasters and their listeners. Under MMTC, *et al.*'s Rule, the Commission must consider the expectations of those who are already stakeholders before it implements any LPFM service. In doing so, the only conclusion is that the proposed LPFM service is unfeasible, unjustified and irreversible, if implemented.

A. When Compared Objectively, All Receiver Studies Support the Conclusion that Second- and Third Adjacent Protection Separations Cannot be Eliminated.

In its *Notice*, the Commission proposed to make substantial adjustments to its interference protection criteria with no evidentiary basis that such adjustments were possible without increased interference.[7] It solicited studies from interested parties and received three

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6 MMTC, *et al.* Comments at 18.

7 *LPFM Notice* ¶¶ 42-50.

receiver studies.[8] Additionally, the Commission's Office of Engineering and Technology ("OET") began its own testing after the *Notice* was released and subsequently placed its "Interim Report" in the docket after the comment deadline.[9]

The NAB and CEMA data came to virtually the same conclusion, that the Commission cannot eliminate second or third adjacent channel protections for LPFM because receivers generally will not be able to adequately reject the undesired signals that would be created.[10] The OET and NLG conclude that receivers are capable of adequately performing without second and third adjacent channel interference protections.[11]

The National Lawyers Guild has claimed the interference issue to be settled in its favor with the submission of its study.[12] Upon closer examination, it appears as though the OET and NLG studies do not support their positions that the interference protection criteria can be eliminated or reduced for LPFM.

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8 NAB submitted its receiver study as Volume Two of its Comments in MM Docket No. 99-25, filed August 2, 1999; Consumer Electronics Manufacturers Association, National Public Radio and the Corporation for Public Broadcasting submitted a joint receiver study on August 2, 1999; The National Lawyers Guild (NLG) and other LPFM proponents filed a receiver study conducted by Broadcast Signal Lab as part of the NLG's comments filed on August 2, 1999.

9 Office of Engineering and Technology, Federal Communications Commission, Second and Third Adjacent Channel Interference Study of FM Broadcast Receivers, Project TRB-99-3, July 19, 1999 (placed in record on August 3, 1999) [hereinafter OET Study].

10 *See* NAB Comments at 32; CEMA Comments at 13. Please note that although NAB's study did show that most receivers cannot perform up to the existing interference standards under the Commission's rules, NAB is not advocating that the Commission increase its interference protections. While our testing shows that the existing environment may have more interference than the Commission assumes, it is not our position to eliminate interference that already exists, but to maintain the integrity of the spectrum that is left.

11 *See* OET Interim Report at 1; NLG Comments at XII.D.

12 NLG Comments at XII.D.

In order to sort out the information, NAB commissioned two reviews of these four studies. The reports are attached as appendices to these reply comments. Both reports conclude that all of the studies, while somewhat different in scope and methodology, generally support NAB's conclusion that the Commission cannot eliminate second and third adjacent channel protections.

1. Only NAB's study fairly represents all receiver categories.

One of the most obvious differences between the studies revolves around the receivers tested – specifically how many and which kind. The selection of receivers is very important and NAB took great pains to make sure that our sample was representative of the entire universe of receivers.[13] The importance of receiver selection was also pointed out in Comments of John Anderson, an LPFM proponent. Anderson notes that:

> "Because of a lack of data on the ability of receivers to discern between a full-power radio station on one channel and a low power station on a nearby frequency, it is also imperative that any receiver studies of this kind use 'real world' standards – the way a digital car radio responds in a such a situation would be much different from the way a cheap Walkman would, and such studies can be skewed to show one conclusion over another simply by the kind of receivers used by it." Comments of John Anderson in MM Docket 99-25, filed July 26, 1999.

While Anderson did not test any receivers himself, his statement implies that, as with any scientific study, it is possible to dictate an outcome depending on selection of variables. In this case, the type, model and price of different radios will lend different results. This observation is not a new revelation, but it is important to keep in mind when evaluating the studies.

NAB chose to test at least five (5) receivers in five (5) different categories – car, home stereo, portable, personal and clock radio – in order to avoid a bias in the testing results. NAB

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[13] NAB Comments, Volume Two, Exhibit C at 5.

also tested three additional automobile radios to provide some measure of OEM car radio performance,[14] and tested a full price range of receivers in all categories. Receiver selection is one of the most obvious differences between the four studies. For example, OET tested 21 receivers – nine (9) component/home stereo receivers; seven (7) car radios; and five (5) portable radios. OET did not test clock radios or personal radios even though these two types make up a significant portion of the universe of receivers.[15] CEMA, too, ignored clock radios, and tested only one personal radio.[16] While the NLG did test at least one radio in each category, its receiver sample was so small that, by itself, it is not useful for deriving general conclusions about receiver performance. The NLG tested only one clock and one personal radio.[17] The NAB study, by far, most fairly represented all common receiver categories in its receiver sample.

2. The CEMA, NAB and NLG test data are mutually supportive.

To understand how the results obtained by even the low power FM proponents support maintaining second and third adjacent channel interference protection criteria, it is useful to look at the data for portable radios. CEMA, OET, and NAB each tested five portable radios, and the NLG tested three such radios. Thus, the portable radio test results provide a good opportunity to compare the results obtained by each group. Because the number of clock radios and personal

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14 NAB Comments, Volume Two, Exhibit B at 19.

15 *Second and Third Adjacent Channel Interference Study of FM Broadcast Receivers*, OET Report FCC/OET TRB-99-1, July 1999 ("OET Study") at 5. ("No [inexpensive receivers with integral antennas] were selected for the test sample because of the difficulty of providing test signals at accurately controlled levels to this type of device.")

16 *FM Receiver Interference Tests Laboratory Test Report*, published by the Consumer Electronics Manufacturers Association, July 27, 1999 ("CEMA Study") at the unnumbered fourth page of Test A description in main body of report.

17 NLG Study at Appendix F.

radios tested by CEMA, the OET and the NLG was very limited, and in some cases zero, a good comparison of the data collected across the various studies for these radios is not possible. There was general agreement across the various studies that the generally more expensive automobile radios, and, in some cases, component receivers, tend to be more effective at rejecting adjacent channel interference than clock, personal and portable radios.

Table 1 is a summary of the data collected in each study for portable radios. The number in parentheses next to the radio description is the desired signal received power level at which the radio was tested. The desired-to-undesired ("D/U") signal ratio reported in each case is the ratio at which the particular study showed interference to occur.

For the CEMA study, interference was considered to occur when the desired programming out of the receiver's speakers had a signal-to-noise ratio no greater than 45 dB.[18] For the NAB study, interference was considered to occur when the desired programming out of the receiver's speakers had a signal-to-noise ratio no greater than 50 dB or, for radios that could not achieve a 55 dB signal-to-noise ratio without any interference present, when the desired programming had a signal-to-noise ratio that was 5 dB below the interference-free signal-to-noise ratio.[19] The NLG presented data tables in Appendix G of its study that reported the audio signal-to-noise ratio measured as the undesired signal was set to levels above and below the current FCC protection standards in 10 dB increments.[20]

In order to extract figures for Table 1 from the NLG data, we performed linear interpolations to estimate the D/U ratio at which a 50 dB audio signal-to-noise ratio would be

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18 CEMA Study, Test B at 1.

19 NAB Comments, Volume Two, Exhibit A at 5.

20 NLG Study at Appendix G.

achieved. In cases where the NLG did not test the radio at a low enough undesired signal level to produce meaningful results, we simply used the lowest undesired signal level tested.[21] The result is that, for the NLG data, Table 1 greatly overestimates the ability of portable receivers to reject adjacent channel interference. The NLG used several different types of modulating signals on its undesired signal, however not one of them was the standard weighted noise recommended for this type of testing.[22] The data in Table 1 represents the NLG data where a stereo tone was used to modulate the interfering signal. For the OET study, interference was considered to exist when the desired audio from the receiver contained three percent more distortion than it did with no interfering signal present.[23] The data in Table 1 is based upon the OET data for 75 kHz deviation, where the desired signal was stereo and the undesired signal mono.

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21 For example, it is reported that a second adjacent channel interferer broadcasting a stereo tone will cause the desired audio from NLG's receiver number six to have a 28.7 dB signal-to-noise ratio when the interfering signal is only 20 dB above the desired signal. The NLG did not test at any undesired signal levels lower than this, so it is not possible to even estimate what D/U ratio would result in a 50, 45, 40 or even 35 dB audio signal-to-noise ratio. NLG Study, Appendix G at 29.

22 CEMA used clipped pink noise as its undesired audio signal, and when measuring the noise signal it employed a CCIR weighting filter with a spectral response similar to the human ear. CEMA Study at 2 of Test A. NAB used white noise filtered to simulate the spectrum of unprocessed program material as its undesired signal, and when measuring the noise signal it, too, employed a CCIR weighting filter with a spectral response similar to the human ear. NAB Comments, Volume Two, Exhibit B at 5. The OET, too, used clipped pink noise as its undesired audio signal. OET Study at 9.

23 The OET provides no justification for why it measured distortion levels, and why it chose distortion levels that were one percent and three percent above the level of distortion with no interference present. For Table 1 purposes, we assumed that the OET intended the three percent distortion figure to be the one where interference occurs because, if the one percent figure were the point where it assumed interference to occur there would have been no point in collecting the three percent data.

Table 1

Radio	2nd Adjacent D/U (dB)	3rd Adjacent D/U (dB)
CEMA Portable (-50 dBm)	-5.1	> -30
CEMA Portable (-50 dBm)	1.4	> -30
CEMA Portable (-50 dBm)	-16.9	> -30
CEMA Portable (-50 dBm)	-21.9	> -30
CEMA Portable (-50 dBm)	-2.5	> -30
NAB Portable (-55 dBm)	-21.7	-47.7
NAB Portable (-55 dBm)	-20.7	-28
NAB Portable (-55 dBm)	-9	-21
NAB Portable (-55 dBm)	-16.7	-31.7
NAB Portable (-55 dBm)	-4.2	-14.3
NLG Portable (-54 dBm)	> -20	> -20
NLG Portable (-54 dBm)	> -20	-27
NLG Portable (-54 dBm)	-26	-32
OET Portable (-58 dBm)	-39.8	-57.9
OET Portable (-58 dBm)	-26.5	-41.9
OET Portable (-58 dBm)	-55.5	-64.9
OET Portable (-58 dBm)	-45.3	-54.9
OET Portable (-58 dBm)	-37.3	-41.3

Table 2 presents the second adjacent channel data from Table 1 with the receivers sorted from worst to best in terms of rejecting second adjacent channel interference. The results of the OET study indicate that all five of the receivers it tested performed better than all of the other radios tested by the other parties. And, the best radio the OET tested in terms of rejecting second adjacent channel interference was allegedly able to withstand second adjacent channel interfering signals that were 30 dB stronger than the strongest second adjacent channel interfering signals that could be handled by the best of the non-OET radios. With data this far out of line with what three other independent parties came up with, one must seriously question the test methodology employed by the OET. An important thing to remember when looking at Table 2 is that, because the NLG did not test interfering signals that were any less than 20 dB above the desired signal,

the two -20 dB D/U figures for NLG receivers in Table 2 significantly overestimate the ability of these receivers to reject adjacent channel interference.

Clearly, as Table 2 illustrates, the -20 dB D/U second adjacent channel protection ratio for reserved band stations cannot be modified and, of course, neither can the -40 dB D/U protection ratio for non-reserved band stations.

Table 2

Radio	2nd Adjacent D/U (dB)
CEMA Portable (-50 dBm)	1.4
CEMA Portable (-50 dBm)	-2.5
NAB Portable (-55 dBm)	-4.2
CEMA Portable (-50 dBm)	-5.1
NAB Portable (-55 dBm)	-9
NAB Portable (-55 dBm)	-16.7
CEMA Portable (-50 dBm)	-16.9
NLG Portable (-54 dBm)	> -20
NLG Portable (-54 dBm)	> -20
NAB Portable (-55 dBm)	-20.7
NAB Portable (-55 dBm)	-21.7
CEMA Portable (-50 dBm)	-21.9
NLG Portable (-54 dBm)	-26
OET Portable (-58 dBm)	-26.5
OET Portable (-58 dBm)	-37.3
OET Portable (-58 dBm)	-39.8
OET Portable (-58 dBm)	-45.3
OET Portable (-58 dBm)	-55.5

Table 3 is similar to Table 2, except that third adjacent channel data is displayed instead of second adjacent channel data. As was the case for the second adjacent channel data, the NLG did not test interfering signals that were any less than 20 dB above the desired signal, so the -20 dB D/U figure in Table 3 overestimates the ability of that NLG receiver to reject adjacent channel interference. Also, for the third adjacent channel case, only, CEMA's test data has the same deficiency as that of the NLG. CEMA did not test any third adjacent channel interfering

signals that were any less than 30 dB above the desired signal, so the five -30 dB D/U figures for the CEMA receivers in Table 3 also significantly overestimate the ability of these receivers to reject third adjacent channel interference.

Only one of the non-OET portable radios was found to be capable of handling the amount of third adjacent channel interference currently permitted under the Commission's rules. However, the OET found that all of the portable receivers it tested were capable of rejecting third adjacent channel interference to a greater degree than the rules assume.

As was the case with the second adjacent channel interference testing, the OET third adjacent channel data for portable radios was far out of line with the data that the three other independent parties came up with. Thus, the validity of the OET study must be questioned. Clearly, the data obtained by CEMA, NAB and the NLG support the conclusion that the third adjacent channel protection criteria cannot be relaxed.

Table 3

Radio	3rd Adjacent D/U (dB)
NAB Portable (-55 dBm)	-14.3
NLG Portable (-54 dBm)	> -20
NAB Portable (-55 dBm)	-21
NLG Portable (-54 dBm)	-27
NAB Portable (-55 dBm)	-28
CEMA Portable (-50 dBm)	> -30
CEMA Portable (-50 dBm)	> -30
CEMA Portable (-50 dBm)	> -30
CEMA Portable (-50 dBm)	> -30
CEMA Portable (-50 dBm)	> -30
NAB Portable (-55 dBm)	-31.7
NLG Portable (-54 dBm)	-32
OET Portable (-58 dBm)	-41.3
OET Portable (-58 dBm)	-41.9
NAB Portable (-55 dBm)	-47.7
OET Portable (-58 dBm)	-54.9
OET Portable (-58 dBm)	-57.9
OET Portable (-58 dBm)	-64.9

The results of the three non-OET receiver studies submitted into the record in this proceeding unanimously confirm that modern radio receivers do not perform as well as the existing FCC protection criteria for second and third adjacent channel interference assume. Because the OET chose to use its own, apparently arbitrary, criteria for quantifying the effects of adjacent channel interference, its results cannot be used to support relaxation of interference protections.

3. Independent expert analyses of receiver studies submitted in this docket confirm the validity of the NAB study, and the invalidity of the OET study.

Subsequent to the filing of four different receiver studies in this proceeding, NAB commissioned two independent analyses of these studies by independent engineering experts. The first analysis was conducted by the engineering consulting firm Moffet, Larson & Johnson ("MLJ Report"),[24] and the second by Dr. Raymond L. Pickholtz of George Washington University and Dr. Charles L. Jackson ("Pickholtz/Jackson Report").[25]

With respect to the OET test results, MLJ found that "there is an inherent bias in the OET tests because of the sole use of radios with external antennas."[26] MLJ noted also that the OET used distortion as its only measure of audio performance, and that "distortion is a poor choice for use in FM interference testing because it does not correlate well with subjective effects of audible impairment."[27] Overall, MLJ concluded that "the results of the OET tests performed thus far are incomplete and are not useful in assessing performance of contemporary FM

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24 The MLJ Report is attached to these reply comments as Appendix A.

25 The Pickholtz/Jackson Report is attached to these reply comments as Appendix B.

26 MLJ Report at 6.

27 *Id.* at 4.

radios."[28] Pickholtz and Jackson also cited problems with the OET's interference criteria, noting that "the NLG and OET studies use relatively poor measures of receiver performance – ones not supported by traditional engineering practice or accepted standard – which have the consequence of minimizing the effects of interference."[29] Pickholtz and Jackson went on to say,

> "Although we have a few other concerns with the OET's testing procedures, our most significant concern is with the use of THD+N as the criterion of impairment in the presence of interference. This is not the conventional measure in the engineering community; it is unlikely to match consumer preferences; and, when increments in THD+N are measured as defined by the OET, the test process is biased."[30]

MLJ noted a number of problems with the test procedure and analysis conducted by the NLG. MLJ noted that the NLG, like the OET, used distortion as its criteria for determining when unacceptable interference occurs. MLJ said, "As in the OET tests, the NLG tests are flawed because distortion does not relate well to subjective observations of interference and is not sensitive to changes in interference."[31] MLJ also faulted the NLG study for using 100 percent distortion as its standard of interference. MLJ said that

> "[T]otal loss of service occurs at much lower values of distortion than 100%. ... To the best of our knowledge, the Commission has never defined loss of any service, broadcasting or other, as degradation to the point where distortion is 100% or S/N is unity (0 dB) because of concerns over quality of service. Such a definition would result in unusable and severely impaired service within a station's normally protected service contour."[32]

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28 *Id.* at 8.

29 Pickholtz/Jackson Report at 14.

30 *Id.* at 19.

31 MLJ Report at 9.

32 *Id.* at 10.

MLJ noted that, while the NLG's conclusions about receiver performance are not valid because it used an inappropriate measure of interference in its analysis, it did report audio signal-to-noise ratio data in its report and this data "can be analyzed using standard interference criteria to illustrate that the data does not support the NLG's conclusion regarding second and third adjacent channel interference."[33]

Concerning the NAB study, Pickholtz and Jackson found,

> "The criterion of a 5 dB degradation in SNR for the lower-performance receivers is a significant degradation – we expect that most consumers would notice it and that many would find it irritating or annoying. We think that this 5 dB criterion is appropriate but that a good case could have been made for a slightly smaller level of degradation, say 3 dB."[34]

Thus, not only did Pickholtz and Jackson find the interference criteria in the NAB study to be appropriate, they found it to be somewhat *conservative*. Had NAB employed a "3 dB degradation" criteria as suggested by Pickholtz and Jackson, our study would have found receivers to be even *more* susceptible to adjacent channel interference.

Pickholtz and Jackson believe all four studies were misleading when reporting on car radios, stating that such testing should be considered separately by using different standards and test procedures.[35] They said,

> "The physics of multipath radio propagation are well studied and well known, as are the problems of communicating to moving platforms in a multipath environment. Each of us has done research on mobile communications in multipath environments. We believe that it is inappropriate and misleading to use the performance of car radios, tested using a test appropriate to a nonmobile environment but not to a mobile environment, as a guide to the performance of

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33 *Id.* at 12.

34 Pickholtz/Jackson Report at 25.

35 *Id.* at 39.

> consumer receivers under changes to the FCC's rules for 2nd- and 3rd-adjacent channel protection."[36]

The point they are making is very important. Even though the results of all four receiver studies might seem to indicate that car radios are capable of providing acceptable audio in the presence of interference that exceeds the Commission's existing protection criteria, the fact is that mobile car radios are subject to wide variations in both desired and undesired signal levels due to multipath reflections and other factors such as receive antenna orientation. Thus, if a car radio is capable of withstanding, say, second adjacent channel interference that is 50 dB stronger than the desired signal, but it is subject to variations in desired and undesired signal levels of, say, +/-15 dB, then the appropriate FCC protection criteria for this car radio is a -20 dB desired-to-undesired signal ratio (*i.e.*, if the desired signal is in a -15 dB fade, and the undesired signal is at a +15 dB peak, then 30 dB of margin must be incorporated into the 50 dB protection ratio measured in the lab when determining an appropriate protection ratio). Testing performed by Ford Motor Company in 1996 suggests that the +/– 15 dB assumption is reasonable.[37]

Overall, MLJ concluded that

> *"[T]he OET, CEMA and NLG test results, as well as the NAB results, do not support the hypothesis that receivers have improved over the years with regard to interference rejection performance.* The OET tests are fundamentally flawed. The most valid NLG data and the CEMA data also support NAB's conclusions regarding interference from proposed LPFM stations. These tests do not uphold the contention that third and even second adjacent channel interference from LPFM stations can be ignored."[38]

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36 *Id.* at 36.

37 Michael Chrysochoos and Richard Zerod, *DAB Field Test Project Antenna Characterization Report* at Appendix C (July 9, 1996).

38 MLJ Report at 19 (emphasis added).

Pickholtz and Jackson concluded that, "Despite the fact that the sponsors of these studies used them to argue for different policy outcomes, there are great areas of agreement among studies. ... Specifically, the measurements in the NLG and the NPR et al. studies indicated the majority of receivers suffered unacceptable interference (with regard to the 50 dB SNR criterion) when subject to undesired signals at the levels in the current FCC rules."[39]

Clearly, the record in this proceeding provides no basis for relaxing second and/or third adjacent channel protection criteria.

4. CEMA's speculation regarding NAB's testing is unfounded.

In its reply comments, CEMA notes that the audio signal-to-noise ratio measured at the receiver output with no interfering RF signal present was generally lower for the receivers tested by NAB than it was for the receivers tested by CEMA/CPB/NPR. CEMA speculates that the likely reason for this difference is problems with input RF coupling in the receivers tested by NAB.[40] This is highly unlikely. It is more probable that the different signal-to-noise results are explained by differences in the measurement procedures employed by NAB and CEMA/CPB/NPR.

It seems improbable to us, particularly for the tests involving receivers with external antenna connections, that the input RF coupling in the NAB tests differed significantly from that in the CEMA/CPB/NPR tests. Furthermore, we note that the NAB tests employed a return loss bridge to directly measure the reflected power from the receiver load in order to make whatever

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39 Pickholtz/Jackson Report at 40.

40 CEMA reply comments at Appendix A, at 9.

adjustment in input power necessary to ensure that the specified input signal level was actually delivered to the receiver.[41]

A more likely explanation for the difference in unimpaired signal-to-noise results obtained by NAB and CEMA/CPB/NPR is the different measurement procedures followed in the two tests. In the NAB tests, the receiver under test was connected to its speakers and its volume control was adjusted to produce an audio output that was comfortable to moderately loud.[42] In the CEMA/CPB/NPR tests, the receiver under test was not connected to its speakers. Instead, resistors were used to load the speaker output of the receiver.[43] The audio signal level in the CEMA/CPB/NPR tests was selected to be about 10 dB below rated output or clipping.[44] Because the CEMA/CPB/NPR test procedure did not involve adjusting the volume control of the receiver under test in the same manner employed by NAB, it is very likely that the audio output signals that were measured by CEMA/CPB/NPR were of a different level than those measured by NAB.

It is very important to note that, although the signal-to-noise results obtained by CEMA/CPB/NPR without interfering signals present were generally better than those obtained by NAB under similar conditions, the CEMA/CPB/NPR test results indicate that receivers are generally less able to reject adjacent channel interference than the results of the NAB tests

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41 NAB Comments, Volume 2, Exhibit B, at 8.

42 *Id.* at 15.

43 Thomas B. Keller and Robert W. McCutcheon, *FM Receiver Interference Tests Laboratory Test Report*, July 27, 1999, Appendix A, at 13.

44 The Institute of Electrical and electronics Engineers, IEEE/IHF Standard Methods of Testing Frequency Modulation Broadcast Receivers, ANSI/IEEE Std. 185-1975 at 16 (1975). This is the test procedure followed by CEMA/CPB/NPR. CEMA Comments, Exhibit A at 1.

indicate.[45] Thus, the results of both the CEMA/CPB/NPR and the NAB tests indicate that the second and third adjacent channel protection criteria cannot be relaxed.

5. There is no basis to disregard NAB's study merely because some receivers performed poorly before interference was injected.

On November 8, 1999, NAB representatives met with representatives of the Commission's Mass Media Bureau, and the Office of Engineering and Technology, to discuss the receiver study that NAB submitted with its comments in this proceeding. At this meeting Commission staff questioned the criteria used by NAB to establish when interference exists in an FM receiver. Specifically, it was noted that for some of the radios in the NAB study, the signal-to-noise ratio at the output of the receiver was worse at the 60 dBu contour with no interferer present than it was with an interferer present and causing what NAB had determined to be unacceptable interference at the 70 dBu contour. Commission staff suggested that it was inappropriate to claim that a particular radio could provide service at the 60 dBu contour when its signal-to-noise ratio with no interferers present was below the level at which interference was assumed to exist at the 70 dBu contour with interference present.

The simple fact that a particular receiver has a lower signal-to-noise ratio at the 60 dBu contour without interference present than it does at the 70 dBu contour with interference present is not sufficient evidence to indicate that the receiver cannot provide service at the 60 dBu contour. NAB did not present, and the academic literature does not support, a single minimum signal-to-noise ratio that defines the lower limits of listenable radio service. Our study instead focused on the relative *decrease* in FM quality that would occur if LPFM stations were added to

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[45] *Id.* at Appendix B, pages 3-4; *See also* NAB Comments, Volume 2, Exhibit B, pages 23-25.

the FM band.[46] The Commission must ensure that all listeners, including those who may be receiving degraded, but still usable service, are protected from second and third adjacent channel interference.

Some of the radios in the NAB study had audio signal-to-noise ratios that were poor at certain desired signal levels even without any interferers present. Even if the questionable data points are removed, our conclusions about the need for adjacent channel protection are still valid. Table 4 below identifies the instances where audio quality was significantly worse than "very annoying" even with no interference present. The specific data points where this occurred are identified by the use of strikeouts in Table 4 (receivers 5 and 6 at -55 dBm and receivers 5, 6, 7, 8, 9, 10 and 14 at -65 dBm). The criteria used to determine which radios were significantly worse than "very annoying" was whether or not the radio's signal-to-noise ratio was less than 35 dB.

After identifying the receiver/desired signal level combinations where usable audio quality was not achieved even with no interference present, we went back through our second and third adjacent channel interference data and eliminated the data points for these receiver/desired signal level combinations. We then recalculated the median D/U ratios necessary to avoid interference for both second and third adjacent channel interference at all three desired signal levels. Tables 5, 6 and 7 present this data.

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[46] To the extent that the Commission's staff may be exploring the issue of how much additional interference could be tolerated, that is a different focus than the one adopted by the Commission in the *LPFM Notice*. There, the Commission hypothesized that radio receiver quality had improved to a level where additional radio signals would not impair FM service. As we have demonstrated, that theory is not supported by any of the receiver tests in the record. An argument that LPFM service should be adopted despite the fact that it would degrade the quality of FM service would be directly contrary to the positions taken by all five Commissioners. *See* NAB Comments, Volume One at 37, n.93.

As Tables 5, 6, and 7 illustrate, removing the data points for these poorly performing radios has very little impact on the overall results. Using the recalculated data, the D/U protection ratios necessary are as follows:

Desired Signal Level	**-45 dBm**	**-55 dBm**	**-65 dBm**
2nd adjacent channel protection (median D/U)	-17.0 dB	-21.2 dB	-30.8 dB
3rd adjacent channel protection (median D/U)	-26.8 dB	-32.1 dB	-38.2 dB

Table 4 – Signal to Noise Ratio without Interference

Receiver Number	Receiver Category	Desired Signal Level		
		-45 dBm	-55 dBm	-65 dBm
1	* Clock	36.7	36.1	36.6
2	* Clock	46.0	45.6	44.3
3	* Clock	47.9	47.7	46.5
4	* Clock	40.2	40.3	40.3
5	Personal	43.3	~~33.8~~	~~23.1~~
6	Personal	39.6	~~29.9~~	~~19.9~~
7	Personal	44.7	35.7	~~25.3~~
8	Personal	47.8	38.2	~~28.4~~
9	Personal	47.3	38.0	~~30.1~~
10	* Portable	51.9	44.6	~~17.4~~
11	Clock	42.0	42.0	41.5
12	* Portable	53.1	53.1	52.8
13	Portable	49.9	49.6	49.7
14	Portable	44.0	35.6	~~25.2~~
15	Portable	51.1	50.3	46.3
16	Component	59.0	58.6	56.8
17	Component	54.8	54.4	51.9
18	Component	53.3	53.1	52.4
19	Component	49.7	49.9	49.5
20	Component	54.5	54.5	54.3
21	Automobile	54.6	54.4	51.1
22	Automobile	46.6	46.5	44.3
23	Automobile	46.4	46.4	46.3
24	Automobile	61.5	61.1	58.7
25	Automobile	49.5	44.2	41.1
26	Automobile	49.6	49.6	49.1
27	Automobile	53.6	53.4	52.2
28	Automobile	59.6	59.1	56.1
Minimum		**36.7**	**35.6**	**36.6**
Maximum		**61.5**	**61.1**	**58.7**
Median		**49.6**	**48.7**	**49.5**

Note: Asterisk denotes a monaural receiver

Table 5 – D/U Ratio Required to Produce Interference

-45 dBm Desired Signal Level

Receiver Number	Receiver Category	2nd Adjacent	3rd Adjacent
1	* Clock	-17.9	-25.4
2	* Clock	-28.0	-35.8
3	* Clock	-13.4	-27.2
4	* Clock	-6.4	-9.7
5	Personal	-23.6	-27.9
6	Personal	-16.2	-25.9
7	Personal	3.2	-21.9
8	Personal	-15.8	-26.3
9	Personal	-7.3	-23.8
10	* Portable	-19.7	-37.4
11	Clock	-15.8	-34.6
12	* Portable	-10.0	-17.2
13	Portable	-2.9	-11.4
14	Portable	-12.9	-27.2
15	Portable	-2.1	-11.9
16	Component	-6.9	-12.8
17	Component	-24.8	-22.2
18	Component	-21.8	-21.1
19	Component	-19.6	-23.6
20	Component	-37.9	-39.3
21	Automobile	-15.0	-51.7
22	Automobile	-26.4	-30.8
23	Automobile	-53.6	-51.7
24	Automobile	-45.9	-49.6
25	Automobile	-14.0	-21.8
26	Automobile	-53.3	-55.4
27	Automobile	-44.5	-56.6
28	Automobile	-45.0	-46.3
Median		**-17.0**	**-26.8**

Note: Asterisk denotes a monaural receiver

Table 6 – D/U Ratio Required to Produce Interference

-55 dBm Desired Signal Level

Receiver Number	Receiver Category	2nd Adjacent	3rd Adjacent
1	* Clock	-17.6	-28.9
2	* Clock	-32.6	-36.2
3	* Clock	-15.1	-29.5
4	* Clock	-12.4	-16.9
~~5~~	~~Personal~~	~~-30.8~~	~~-27.3~~
~~6~~	~~Personal~~	~~-27.4~~	~~-32.2~~
7	Personal	-5.5	-32.9
8	Personal	-25.6	-36.5
9	Personal	-15.3	-33.8
10	* Portable	-21.7	-47.7
11	Clock	-16.7	-35.7
12	* Portable	-20.7	-28.0
13	Portable	-9.0	-21.0
14	Portable	-16.7	-31.7
15	Portable	-4.2	-14.3
16	Component	-15.5	-21.2
17	Component	-31.8	-32.1
18	Component	-31.4	-30.8
19	Component	-26.6	-31.9
20	Component	-45.8	-49.2
21	Automobile	-17.2	-31.7
22	Automobile	-27.7	-30.4
23	Automobile	-64.7	-65.2
24	Automobile	-61.0	-57.1
25	Automobile	-15.5	-21.6
26	Automobile	-61.5	-65.3
27	Automobile	-45.1	-60.2
28	Automobile	-41.9	-43.9
Median		**-21.2**	**-32.1**

Note: Asterisk denotes a monaural receiver

Table 7 – D/U Ratio Required to Produce Interference
-65 dBm Desired Signal Level

Receiver Number	Receiver Category	2nd Adjacent	3rd Adjacent
1	* Clock	-17.2	-28.0
2	* Clock	-35.1	-39.4
3	* Clock	-16.0	-30.1
4	* Clock	-14.3	-21.4
~~5~~	~~Personal~~	~~-35.4~~	~~-45.6~~
~~6~~	~~Personal~~	~~-32.3~~	~~-36.0~~
~~7~~	~~Personal~~	~~-16.4~~	~~-42.3~~
~~8~~	~~Personal~~	~~-33.2~~	~~-44.7~~
~~9~~	~~Personal~~	~~-24.9~~	~~-40.8~~
~~10~~	~~* Portable~~	~~-27.8~~	~~-59.0~~
11	Clock	-19.1	-36.4
12	* Portable	-30.2	-36.5
13	Portable	-11.2	-22.2
~~14~~	~~Portable~~	~~-22.8~~	~~-45.1~~
15	Portable	-7.9	-18.3
16	Component	-25.4	-30.0
17	Component	-39.1	-42.0
18	Component	-41.4	-38.2
19	Component	-35.1	-38.3
20	Component	-53.4	-56.6
21	Automobile	-30.8	-40.4
22	Automobile	-30.1	-34.0
23	Automobile	-71.5	-67.0
24	Automobile	-61.3	-45.3
25	Automobile	-26.0	-31.1
26	Automobile	-61.9	-63.8
27	Automobile	-44.8	-59.1
28	Automobile	-39.1	-39.9
Median		**-30.8**	**-38.2**

Note: Asterisk denotes a monaural receiver

Thus, even if the Commission staff's concerns about the unimpaired performance of some of the radios that we tested are addressed by removing the data for the radios/desired signal levels in question from our analysis, it does not alter the end result. The second and third adjacent channel protection criteria still cannot be relaxed without significantly degrades FM service.

6. Receiver antenna height assumptions do not bias NAB's study results.

In his Reply Comments, J. Rodger Skinner, Jr. claims that a "fudge factor" was built into the NAB receiver study "in an attempt to weaken the received (desired) signal by 10 dB, to try to make it easier to show interference from the undesired LPFM signal."[47] He says that "by reducing the desired signal strength by 10 dB, as done with a fudge factor as described above, the end result would be less signal required from the undesired (LPFM) to show interference to the desired station."[48]

Skinner's reference to the "fudge factor" is based on the discussion in NAB's comments about how a given amount of power received at the antenna terminals of a receiver correlates to different predicted field strength contours around an FM broadcast station depending on how high above ground the receive antenna is assumed to be.[49] Skinner argues that all automobiles should be assumed to have antennas that extend 30 feet above ground level, that all joggers with Sony Walkman-style radios should be assumed to have antennas that extend 30 feet above ground level, and that all other radios should be assumed to have antennas that extend 30 feet above ground level.[50] These are the same assumptions that are currently embodied in the Commission's rules.[51]

Our comments did not ask the Commission to modify its current practice of measuring and predicting received field strength based upon a receiver antenna height of 9 meters (30 feet).

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47 Reply Comments of J. Rodger Skinner in MM Docket No. 99-25 at 2 (filed September 17, 1999).

48 *Id.*

49 NAB Comments, Volume 2, Exhibit A, at 3.

50 Skinner Reply Comments at 3.

51 47 C.F.R. § 73.314(b)(2).

We note that our data show that when a 9 meter (30 foot) antenna height is assumed, as preferred by Skinner, *more* protection is needed from second and third adjacent channel interferers at both the city grade (70 dBu) and 60 dBu contours than when a 1.5 meter (5 foot) antenna height is assumed. This is illustrated in Tables 8 and 9.

Table 8

Required Second Adjacent Channel Protection Ratios (Desired-to-Undesired)
(Median of 28 Radios Tested by NAB)

1.5 m Receiver Antenna Height	9 m Receiver Antenna Height
70 dBu (-55 dBm) –23.7 dB	70 dBu (-45 dBm) –17.0 dB
60 dBu (-65 dBm) –30.5 dB	60 dBu (-55 dBm) –23.7 dB

Table 9

Required Third Adjacent Channel Protection Ratios (Desired-to-Undesired)
(Median of 28 Radios Tested by NAB)

1.5 m Receiver Antenna Height	9 m Receiver Antenna Height
70 dBu (-55 dBm) –32.0 dB	70 dBu (-45 dBm) –26.8 dB
60 dBu (-65 dBm) –39.7 dB	60 dBu (-55 dBm) –32.0 dB

In suggesting that the 1.5 meter (5 foot) receiver antenna height assumption biases the interpretation of our data in favor of more adjacent channel protection, Skinner appears to have misinterpreted the data we presented. His citation of a quote from Volume Two, Exhibit B, page 28 of our comments[52] as evidence to support his claim appears to indicate that he mistakenly read this to say, "As was the case for 3rd adjacent channel interference, a substantial increase is observed in the *absolute value of the* D/U ratio required to produce interference in the

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52 Skinner Reply Comments at 2.

median receiver with increasing desired signal strength." The actual quote from our comments does not refer to absolute value, and in fact the tabular data presented on the same page with this quote clearly contradicts Skinner's interpretation.[53]

Because the D/U ratios necessary to protect against second and third adjacent channel interference are generally negative numbers, a receiver that is more sensitive to this type of interference will have a higher D/U ratio (*i.e.*, a D/U ratio that is less negative). However, the absolute value of the D/U ratio for the more sensitive receiver will be lower. It must be noted, however, that regardless of what receiver antenna height is assumed, our data clearly illustrates that the second and third adjacent channel protection criteria cannot be relaxed.

7. The willingness of LPFM proponents to accept more interference in order to gain spectrum contravenes Commission policy of providing quality service.

Several LPFM proponents suggest that if LPFM service is established, LPFM stations should be willing to accept more interference from full-power broadcasters.[54] These suggestions

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53 NAB Comments, Volume Two, Exhibit B, at 28.

54 Comments of Michigan Music is World Class Campaign ("MMWCC") in MM Docket No. 99-25, filed July 28, 1999, at 64 ("We agree with the idea that LP-100 stations should *be permitted to select channels without regard to interference received from other stations*"); Comments of the Prometheus Radio Project in MM Docket No 99-25, filed July 29, 1999, at 14 ("The LP100 stations should be able to apply for frequencies where they will receive some interference, so long as they do not cause significantly greater interference to other stations"); NLG Comments at III ("We find it reasonable that LPFM stations be allowed to receive greater interference than they otherwise would under "primary" status"); Comments of J. Rodger Skinner in MM Docket No. 99-25, filed July 29, 1999 at ¶ 26 ("I believe that although LPFM LP-1000 stations should not cause interference to any primary station, they should be allowed to receive interference from such stations. LP-100 stations should also be allowed to receive interference"); Comments of the ACLU Massachusetts, *et al.* in MM Docket No. 99-25, filed June 3, 1999 at 12 ("LPFM stations should be willing to accept a higher than normal level of interference").

appear to be an attempt to "negotiate" a slice of the spectrum pie no matter what the cost – even if it adversely affects the potential service area of the LPFM station.

As NAB pointed out in our Comments, reality bears out a different result. In one scenario, a predicted service area for a LP100 station virtually would be wiped out by the signal of a nearby Class B station based on the median receiver protection ratio for second adjacent channel interference in NAB's study.[55] In this example, 95.8% of the LP100 station's 60 dBu contour would be interfered with by the full-power station.[56] Assuming that the public interest objective of creating a low power radio service would be to provide new service to the public, rather than simply providing an outlet for amateur broadcasters, the high levels of interference that listeners to LPFM stations would receive suggests that – as conceived by the Commission – the LPFM service would not result in a public interest benefit.

NAB's arguments in this regard are supported by the separate engineering study submitted by The Walt Disney Company. Using the receiver data developed by NAB, Disney studied the impact of several LPFM stations that the Commission's feasibility study located near a Disney-owned radio station. Disney demonstrated not only that listeners to its full-power stations would receive interference, but that the low power stations would have only negligible numbers of potential listeners who could receive the stations without interference. In Atlanta, for example, assuming reception with the median portable radio in NAB's study, of the 370,000 potential listeners to one of the projected LP 1000 stations, only 20,000 would not receive interference from WKHX-FM. The net result would be that allocating the proposed LPFM

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55 NAB Comments at 26 – 27.

56 *Id.*

station "would create 31 more times interference for portable radios than service created."[57] Similar results were obtained in other Disney markets.

As NAB pointed out, the Commission has long recognized what Disney found – that low power radio service is inherently spectrum inefficient because it inevitably results in far more new interference than new service.[58] Nothing in the comments of LPFM proponents provides any basis on which the Commission could reach a different conclusion now.

The arguments of LPFM operators that they should be permitted to establish operations that would be subject to such high levels of interference, therefore, should not be accepted. The goal of the Commission's technical rules is to create a high quality radio service. Because of the public's interest in maintaining the quality of radio service overall, the Commission has been reluctant to allow short-spacing and other exceptions to the FM rules, even when the stations involved might be agreeable.[59] The Commission, therefore, should not risk damaging the overall quality of FM service merely because some LPFM proponents now claim that they would be willing to accept high levels of interference.

B. The Commission Must Listen to the Experts Regarding the Development of IBOC DAB.

Most of the LPFM proponents do not have an adequate response to the technical issues surrounding IBOC DAB. If addressed at all, they merely dismiss it as an unnecessary new

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57 Comments of The Walt Disney Company in MM Docket No. 99-25 at 4 (filed August 2, 1999).

58 NAB Comments, Volume One at 50-51.

59 *See* NAB's Comments in MM Docket 98-43 ("*Technical Streamlining*") at 9 – 10 (filed October 20, 1998). Please note that even under the FCC's proposal to allow negotiated interference, it would only allow such agreements if the net effect was a substantial increase in radio service. *Technical Streamlining* Notice of Proposed Rule Making, MM Docket No. 98-93 at ¶ 17.

technology[60] or revert to the argument that the Eureka 147 system should be implemented instead.[61] In the Comments of MMWCC, they contend that "at least six different competing technologies, including IBOC and Eureka 147" exist for terrestrial digital broadcasting.[62] But nowhere do they describe what these other four digital radio technologies are. Other unsubstantiated and unsupported claims permeate MMWCC's comments, such as:

- "Some competing terrestrial digital systems claim an efficiency capable of squeezing five times as many channels into the same amount of spectrum space";
- "We are informed that analog FM is more robust at penetrating steel reinforced buildings, and that the "picket-fencing" associated with analog is nothing compared to the "shelf effect" of terrestrial digital";
- "We are also concerned about reports that in fact IBOC has not worked very well so far. In fact, trade papers are full of articles outlining the failure of IBOC to work properly." MMWCC Comments at 37 – 38.

While generally it may be true that ignorance is bliss, in this proceeding, the Commission must acknowledge the ignorance of LPFM proponents regarding IBOC DAB and look to the experts in this arena. This issue cannot be dismissed lightly as some LPFM proponents have tried to do. IBOC DAB cannot be dealt with after LPFM because a decision in this proceeding may prevent or harm the development and implementation of IBOC DAB.

Two of the three IBOC DAB proponents have filed comments in this docket. They have attempted to address some of the questions posed by the Commission in the *Notice*. However,

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60 Recently, Lucent Technologies, Inc. conducted a survey regarding digital radio. In that limited survey, over half of the public polled (56 percent) indicated an interest in having digital radio available. *See* Press Release, Lucent Digital Radio Survey of all Americans want digital radio, released August 30, 1999. Also, as noted by Lucent in its comments in this proceeding, the Commission has been interested in digital radio and has been acquiring information since 1990. Comments of Lucent Technologies in MM Docket No. 99-25, filed August 2, 1999 at 2. *See also DAB Notice* ¶ 1.

61 *See e.g.*, Comments of the National Lawyers Guild at XIII; Comments of MMWCC at 36; Comments of J. Rodger Skinner at 36.

62 Comments of MMWCC at 36.

without further data and testing, there is no way to fully understand the potential impact of LPFM on IBOC DAB.

USA Digital Radio, Inc. acknowledges in its comments that its field tests are currently ongoing and expects to complete this phase of field testing by the end of this year.[63] The practical result is that the Commission will have more information regarding IBOC in a few short months. More information on IBOC naturally leads to a better understanding of the system and its operation in the current FM interference environment.

Both Lucent and USADR expressed concerns in their comments regarding the Commission's proposal to eliminate second and third adjacent channel protections. Lucent is "pessimistic" about placing LPFM stations on adjacent channels.[64] Its initial analysis of the LPFM proposal and its effect on Lucent's IBOC system "suggests that it will be difficult for additional low power analog and new digital IBOC signals to co-exist and serve their intended service areas."[65]

USADR commissioned a study to examine second adjacent channel interference to its IBOC system. In its "worst case scenario," USADR found a predicted radius of interference of 3.8 kilometers from one 1000-watt LPFM station operating at the edge of coverage of an FM station, and multiple LPFM stations would only exacerbate the problem.[66] However, USADR

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63 Comments of USA Digital Radio Inc.("USADR") in MM Docket No. 99-25, filed August 2, 1999 at 5.

64 Lucent Comments at 5.

65 *Id.*

66 USADR Comments at 7.

points out that there is not enough information to predict the full impact of LPFM until actual implementation of IBOC in the field.[67]

The Commission asked for information regarding the impact of its LPFM proposal on the implementation of IBOC in this proceeding. It asked virtually the same question in its recently-released *Notice* on DAB where it inquired about the compatibility of IBOC systems with the proposed LPFM service.[68] The Commission also requested comment on the potential for enhancing the robustness of IBOC systems to reject second and third adjacent channel signals and the likely impact of those modifications.[69]

The Commission, in this proceeding, received preliminary, but detailed, reports from two organizations that know exactly what IBOC DAB can and will be. The Commission also received many unsupported claims and contentions from LPFM proponents. What should be taken away from all these comments is that LPFM would impact IBOC. The degree to which each would be affected by the other is unknown without IBOC field testing. Thus, the Commission cannot move forward with LPFM service until it reaches some conclusions about the development of digital radio.

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67 *Id.*

68 *DAB Notice* ¶ 25.

69 *Id.* The Commission alluded to comments of USADR which it suggested might support elimination of protections for third adjacent channel interference without risk to IBOC. *DAB Notice* ¶ 25. Just as evaluating the performance of IBOC systems generally must await field testing, and not rely only on laboratory testing or computer modeling, the Commission cannot place additional interference in the FM band on the assumption that IBOC will not be affected unless field testing confirms that third adjacent channel interference would not diminish IBOC service.